MONTHLY WEATHER REVIEW,

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(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to November 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 134 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 145 monthly journals and 145 monthly means from the former, and 13 monthly means from the latter; reports from 31 Sunset stations; 240 monthly registers from Voluntary Observers; 26 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown the general distribution of the atmospheric pressure for the month, as reduced to sea-level, by the isobaric lines. The mean pressure for the present month, when compared with the average for December of the past seven years, is higher for the Atlantic States, Lake region, Minnesota and eastern Dakota, being greatest for New England—from 0.11 to 0.22 of an inch. It is about normal for Florida and California. For the remaining sections it is generally lower, especially in the Rocky Mountain regions. It varies from 0.14 of an inch below on Pike's Peak to 0.19 at Virginia City.

Local Barometric Ranges.—These have been least in Florida, New Mexico and southern California. They have been greatest over the western portions of Kansas and Nebraska, northwestern Dakota, Lake Superior, Maine, Idaho, and northern California. By districts they are as follows: New England, 1.01 to 1.40 inch; Middle Atlantic States, 0.83 to 1.12 inches; Lower Lake Region, 1.08 to 1.20 inch; Tennessee and the Ohio valley, 0.74 to 1.05 inch; Upper Lake Region, 1.04 to 1.54 inch; Upper Mississippi valley, 1.08 to 1.34 inch; Red River of the North Valley, 1.19 to 1.40 inch; Lower Missouri valley, 1.43 to 1.45 inch; Upper Missouri valley, 0.95 to 1.54 inch; Eastern Rocky Mountain Slope, 0.70 to 1.60 inch; Virginia City, 0.94 inch; Salt Lake City, 1.29 inch; Winnemucca, 1.16 inch; Boise City, 1.34 inch; Portland, Or., 1.25 inch; Central Pacific Coast region, 0.95 to 1.37 inch; Los Angeles, 0.75 inch; New Mexico, 0.64 to 0.79 inch; Western Texas, 0.56 to 1.58 inch; Western Gulf States, 0.74 to 1.15 inch; Eastern Gulf States, 0.71 to 0.77 inch; South Atlantic States, 0.59 to 0.87 inch; Key West, 0.32 inch.

Areas of High Barometer.—Of these eleven are described. Nos. IV, IX and X are the most interesting on account of the low temperatures accompanying them, especially No. IX.

No. I.—On the 1st this high area approached the Northwest from British America. Its progress southward was prevented by low-pressure, No. II, then advancing eastward; in fact it was forced to remain north of the Lake region on the 2nd. North of Pembina the temperature fell below zero. During the afternoon of the 3rd the barometers at Chatham, N. B., and Sydney, C. B., rose to 0.55 and 0.56 in., respectively, above the normal. On the following day it disappeared over the Gulf of St. Lawrence in advance of low No. II.

No. II.—It advanced southeastward on the 4th toward the St. Lawrence valley, with its southwestern side covering the Lake region. Morning of the 5th it covered the lower St. Lawrence valley and New England; a. m. barometer at Quebec, 30.56 in., or 0.61 in. above the normal; midnight at Sydney, 0.71 above. During the 6th it passed eastward as low pressure No. III approached.

No. III—made its appearance in the extreme Northwest on the 7th. The morning minimum temperatures were below zero from northeastern Montana to northwestern Minnesota; —15° Fah. at Fort Stevenson, Dakota, and —29° at Humboldt, B. A. During the 8th it progressed eastward with the central highest pressure north of the Lakes. The a. m. minimum temperature at North Platte was —13°. It crossed the St. Lawrence valley on the 9th. The midnight barometer at Chatham was 30.69 or 0 86 in. above the normal. 10th—During the approach of low pressure No. V, it withdrew to the eastward.

No. IV.—On the 10th the pressure, which had been below the normal from the North Pacific coast east and southeast beyond the Mississippi valley, began increasing. By midnight it was highest in Dakota. 11th, a. m. barometer at Yankton, 0.39 above the normal; minimum temperatures below zero from Colorado and western Kansas to Montana, Dakota, Minnesota, and northwestern Wisconsin, and —23° at Fort Stevenson. Cold, high northerly winds, and at places gales marked its advance; on the Texas coast quite a severe "norther," with a maximum hourly wind velocity of 40 miles at Indianola. 12th, in the morning heavy frosts occurred over the interior of the Gulf States, and light frost at places along the coast. The central highest pressure moved from the Northwest to the Ohio valley by midnight. At Pembina the a. m. minimum temperature was —41°. During the 13th, with increasing central pressure, it moved to New England, Nova Scotia and Brunswick; midnight barometer at Chatham, 30.78 or 0.95 above the normal. Excepting the Pacific, Gulf and South Atlantic coasts, the morning minimum temperatures were below freezing, and below zero in the lower St. Lawrence valley. 14th, a. m. barometer at Halifax 30.80 or 0.96 above the normal. During the day it passed eastward beyond Nova Scotia, and the pressure rapidly decreased as low pressure No. IX advanced.

No. V.—From the 10th to the 15th the pressure continued considerably above the normal in the Middle Pacific Coast region. The central highest pressure was, apparently, at some distance off the coast and oscillating northward to the North Pacific coast, and southward to the South Pacific coast. On the 14th it extended southeastward, and on the 15th and 16th it gradually disappeared over Arizona.

No. VI—appeared night of the 13th in the extreme Northwest. The a. m. minimum temperature at Pembina on the 14th was —28°. It moved southward very rapidly during the day. Morning of the 15th it appeared as a narrow barometric ridge extending from the Red River of the North valley to Texas, with decreasing pressure and minimum temperature of —30° at Breckenridge. Upon this and the following days it gradually passed south and eastward across the Southern States, and disappeared off the South Atlantic coast.

No. VII.—Following low pressure No. X, it rapidly advanced southward from British America over the Northwest on the 16th, with brisk to high northerly winds and cold weather. Morning of 17th the barometer at Breckenridge read 30.66, or 0.43 above the normal. The a. m. minimum temperature was below zero from the northern portions of Iowa and Nebraska to Wisconsin, Minnesota, Dakota and Montana; —28° at Fort Keogh, —30° at Fort Buford, and —38° at Fort Garry. During the day it advanced southeastward to the Upper Mississippi valley, with the pressure slightly above 30.50 in. During the 18th it began breaking up as it passed eastward on account of the developement of low pressure No. XI in the Rocky Mountain region. Morning of the 19th the pressure was highest in the South Atlantic States and St. Lawrence valley. The former was dissipated during the day, while the latter rapidly passed southeastward over Nova Scotia in advance of low pressure No. XII. Cautionary Off-shore signals were ordered on the morning of the the 17th along the Texas coast for a "norther;" afternoon, for the New Jersey and northern North Carolina coasts. Morning of the 18th for the central North Carolina coast; afternoon, they were changed to Cautionary along the North Carolina coast. Excepting for the last section the Signals were only justified at scattering stations.

No. VIII.—The southern portion of this extensive high-pressure area was felt throughout the Northwest on the 19th, the centre having been in Manitoba. Morning of the 20th the minimum temperature at Pembina and Fort Garry was —40°; barometer at Fort Garry, 30.71, and 0.47 above the normal at Duluth. As it moved eastward to the north of the lakes it produced cold weather from the Northwest eastward over the Lake region to the St. Lawrence valley and New England, with brisk to high northerly winds. 21st, a. m. minimum temperature generally below zero from New England to the northern portion of the Upper Lake region and —34° at Ottawa, Canada. By midnight it was central in the lower St. Lawrence valley; barometer at Father Point, 30.88, and 0.85 above the normal at Quebec. 22nd, as low pressures Nos. XIII and XIV approached it moved eastward beyond Nova Scotia.

No. IX.—The pressure began to increase throughout the Northwest on the 22nd, with cold weather. The midnight temperature at Humbolt, B. A., was —40°. 23rd, the advance of low pressure No. XVI caused it to divide into two portions, one of which moved over the Middle States, New England and the Gulf of St. Lawrence. The other advanced southward over the Northwest toward the Southwest, with high northerly winds and gales and very cold weather. On the morning of the 24th the minimum temperature was below zero from northern Indian Territory to western Wisconsin, Minnesota, Dakota, Montana, Idaho, the eastern portions of Washington Territory, Oregon, Nevada and probably northern portions of Arizona and New Mexico; at Dodge City, —10°; Pioche, —13°; Dayton, (Wash. Ty.,) —17°; Cheyenne, —24°; Bismarck, —38°; Pembina, —59°. Afternoon barometer at Breckenridge, 30.83, or 0.59 above the normal. During the day its advance reached the Texas coast as a severe "norther;" maximum hourly wind velocity at Indianola, 46 miles. In the North Pacific coast region the pressure rose to about 0.60 above the normal.

25th, the highest pressure was central over Indian Territory and eastern Oregon in the morning; minimum temperature, 29° at Yuma, —10° at Prescott, Arizona, and —13° at Santa Fé. Unusually cold weather prevailed from the Pacific coast to the Mississippi valley. In Texas and New Mexico it was particularly severe. Morning of the 26th, it was central in Texas. During this and the following days it gradually passed eastward over the Southern States, with diminishing central pressure.

No. X.—There were indications of the approach of this high area on the 28th from British America. At Battleford, (52° 41' N. 108° 30' W.,) the temperature was reported as —44°. During the 29th it rapidly extended southeastward over the Northwest and Upper Lakes, with cold northerly winds. Minimum temperatures of —40° and —43° were recorded in the morning at Pembina and Fort Garry, respectively. On the 30th it moved toward the St. Lawrence valley, producing low temperatures in New York and New England; minimum, —38° at Rockliffe, Can. It passed over and beyond the Gulf of St. Lawrence on the 31st. Cautionary Signals were ordered for northerly winds on the North Carolina coast, and Off-shore Signals from New Jersey to Maine. They were generally justified. Warnings were sent for Nova Scotia, but too late.

No. XI.—The deviations of the barometric readings from the normal figures indicate that this high area crossed the Middle and South Pacific Coast regions on the 30th, and rapidly extended southeastward across the Plateau districts toward the Southwest. At midnight of the 31st, the pressure continued high from California to the Lower Ohio valley, and highest over southern Illinois.

Areas of Low Barometer.—Twenty-one areas of low barometer are described below. Of these, three have crossed the entire country from the Pacific to the Atlantic. Three came from the North Pacific coast and died out in the Rocky Mountain region; four from British America and to the westward of Manitoba; one developed in Texas; one off the Texas coast; one on the North Carolina coast; one over Chesepeake Bay; one on the coast of Maine.

No. I.—On the morning of the 1st, the pressure was below the normal from the Pacific coast eastward to the Northwest, and decidedly so in the North Pacific coast region. This disturbance passed northeastward, as shown on Chart No. I, accompanied by numerous light rains from the Pacific coast to Montana, but changing to snow in latter section.

No. II.—developed on the 1st from the same low pressure as No. I. By midnight the barometer at Omaha had fallen 0.31 in. below the normal, and snow was reported from Dakota to northern Michigan. During the 2nd, light rains and snow were frequent from the Lakes to the Northwest, with occasionally high northerly winds over the Upper Lakes. At night its progress eastward was very much delayed by the high pressure to the northward. 3rd, numerous light rains fell from the Gulf States to the Lakes and St. Lawrence valley, partly as snow in two last sections. An easterly gale prevailed in lower St. Lawrence valley. 4th, its movement over New England and the Gulf of St. Lawrence was very rapid, accompanied by rain to the southward, and by snow, with high northerly winds on its northern side. Maximum hourly wind velocities were recorded as follows: Pike's Peak, W. 54; Duluth, NE. 28; Escanaba, N. 30; Indianola, SE. 35; Quebec, E. gale; Father Point, E. 30 miles. Cautionary Signals were ordered, midnight of the 1st, to be displayed at the Stations along the Upper Lakes and Lake Erie, and warnings telegraphed to Toronto for the Canadian stations along Lakes Huron and Erie, but were only partly justified, over the northern portion of the Upper Lakes.

No. III.—crossed the North Pacific Coast region on the 2nd, producing southerly gales on coast, and rainy weather, thence to Idaho and the Northern half of California. The midnight barometer at Olympia was 0.46 below the normal. During the 3rd it passed into western Colorado, with cloudy and rainy weather from California, Nevada and Utah northward, turning to snow in Montana and Dakota. 4th, as it advanced toward the Mississippi valley, with threatening and rainy weather, partly as snow in Minnesota and Dakota, it increased in energy, and developed into a narrow barometric trough, reaching from Minnesota to Texas at midnight. Thunder-storms were frequent from Texas to the Lower Missouri valley. Before recovering the normal, the pressure again rapidly diminished on this date in the North Pacific Coast region; p. m. barometer at Olympia 29.45 or 0.65 below the normal. Rainy weather and high southerly winds prevailed from thence to Idaho, Nevada and Northern California. During the 5th this second disturbance rapidly advanced southeastward and united with the first, which explains the northeastward movement to Wisconsin, as shown upon the chart. Rainy weather accompanied them from the Southern States to the Upper Lake region, and partly as snow in the Northwest, and gales occasionally occurred. At Madison, Wis., the barometer fell to 29.30, and at La Crosse to 0.63 below the normal at midnight. 6th, as it passed into Canada the rain-area extended to New England, followed by clearing weather from the Southern States to the Northwest. Marquette a. m. barometer 29.27 or 0.66 below normal. 7th, the central depression apparently crossed the mouth of the St. Lawrence, with frequent gales thence to New York, New England and Nova Scotia. Maximum wind-velocities: Red Bluff, SW. 32; on Pike's Peak, W. 56; Indianola, NW. 40; Denison, S. 34; Fort Griffin, S. 40; Dodge City N. 40; North Platte, SE. 42; Cheyenne, W. 50; Breckenridge, SE. 34; St. Paul, SE., and Duluth, E. 32; Alpena, SE. 30; Erie, S. 30; Barnegat, SE. 32; Sandy Hook, NE. 32; Wood's Holl, SE. 40; Portland, SE. 34; Eastport, SE. 36; Father Point, W. 45; Mt. Washington, S. 84 miles. Morning of the 4th Cautionary Signals were ordered for Duluth; afternoon for the remaining stations on Lake Superior, those along Lake Michigan, the Texas coast, and Port Eads mouth of the Mississippi; midnight for Lakes Huron and Erie, and warnings for Canadian stations on Lakes Huron, Erie and Ontario. Morning of the 5th, for New Orleans, Mobile and Pensacola; midnight for Lake Ontario, Cedar Keys, Fla., and along the Atlantic from Florida to

Massachusetts, and warnings for Montreal, Quebec and Ottawa, Canada. Afternoon of the 6th, for the remaining portion of the New England coast, and warnings for the Canadian Maritime Provinces. On the morning of the 7th, those from New Jersey to Massachusetts were changed to Off-Shore Signals, and warnings despatched for Newfoundland. They were well justified, except from Florida to South Carolina.

No. IV.—The center of this low pressure rapidly passed southeast over Washington Territory on the 6th. The 7th it united with a depression in the Southwest, which had developed from storm No. III., and was slowly dissipated over Texas. Rainy weather accompanied it in the North Pacific coast region, changing to snow toward Utah and the Northwest, with high winds at places. In anticipation of increasing northeasterly winds, with snow, from southern Lake Michigan to Lake Erie, Cautionary Signals were ordered at midnight of the 7th, but lowered next morning, having been not justified.

No. V.—During the afternoon of the 7th, the pressure rapidly diminished over the northern half of California. By midnight the storm-center was between San Francisco and Red Bluff, with heavy rain and gales. Heavy snow fell in the northern portions of Nevada and California. Sacramento barometer 0.49 below the normal. 8th, the snow-area extended eastward into Dakota and Nebraska; a. m. barometer at Salt Lake City, 0.66 below normal. 9th, it advanced northeastward toward Wisconsin; the barometric gradients became quite steep, with resulting high winds and gales; a deep barom tric trough formed to the southwest, in which, as the wind shifted suddenly from southerly to northerly, a tornado was caused at Renick, Mo., at 4 p. m. At midnight the rain-area extended from the central Gulf States to the Lakes and Northwest, partly as snow in last district. 10th, a. m. barometer at Duluth 29.17, or 0.82 below normal. Between 12 and 1 a. m. a tornado also occurred at Parker's Station, Scott Co., Mo. As the depression passed into Canada, rainy weather with frequently high winds and gales prevailed to the Gulf and Atlantic coasts, but clearing at night from the Southwest and Northwest to the Ohio valley. 11th, the center passed north of the mouth of the St. Lawrence, but with a deep trough extending southwestward toward the Gulf, in which heavy rains fell. Maximum wind velocities: San Francisco, S. 34; Sacramento, SE. 32; Pike's Peak, W. 44; North Platte, NW. 36; Fort Sill, S. 32; Indianola, N. 39; Bismarck and Pembina, N. 40; Breckenridge and Duluth, NW. 36; St. Paul, W. 40; Milwaukee, E. and W. 36; Alpena, SW. 36; Sandusky, SW. 38; Erie, S. 38; Saugeen, W. 45; Burlington, W. 35; Mt. Washington, SW. 84 miles. On the 9th and 10th thunder-storms occasionally occurred from Iowa, Wisconsin, Michigan and Ohio to Texas and Mississippi. Cautionary Signals were ordered midnight of the 8th for the Upper Lakes and Lake Erie. Morning of the 9th, for the Texas and North Carolina coasts, the latter in anticipation of increasing northeast winds in connection with high pressure No. III, while warnings were telegraphed for the Canadian stations on Lakes Huron, Erie and Ontario; afternoon, for Lake Ontario; midnight, for the New Jersey coast, and warnings for the St. Lawrence valley. Morning of the 10th, for Port Eads, Norfolk, Baltimore and the New England coast; midnight and following morning, warnings for New Brunswick and Nova Scotia. Afternoon of the 10th, they were changed to Off-shore at Indianola, Galveston and Port Eads; afternoon of the 11th, from New Jersey to Maine. The signals were fully justified. Those on the North Carolina coast were continued for several days on account of the northeasterly gales, produced by high pressure No. IV, as it passed eastward.

No. VI.—There was a slight depression which quickly passed southeastward over the North Pacific coast on the 9th, and died out over Utah on the 10th. It was accompanied by rainy weather along the Middle and North Pacific coasts, and snow thence toward Colorado and Wyoming.

No. VII.—The southern edge of this disturbance produced rain on the 11th along the North Pacific coast and snow thence to Utah and Montana. 12th and 13th, cloudy weather with generally light snow was reported from Nevada to Dakota, Montana and changing to rain toward Idaho and Washington Ty. On the latter date it apparently lost its identity southwest of the Lower Missouri valley. Maximum velocity on Pike's Peak, NW. 56 miles.

Nos. VIII and IX.—The former developed off the Western Gulf coast on the 13th, producing rainy weather in the Southern States with increasing northeasterly winds, and on the Texas coast northerly gales. 14th, by afternoon it appeared as a narrow barometric trough extending from the Upper Ohio valley southwest over Alabama into the Gulf, and by midnight in was central in western Pennsylvania. The latter rapidly formed in the morning over eastern North Carolina and moved northeast along the coast, causing northeasterly gales in advance of it. Heavy rains fell from the Lower Mississippi valley to the Atlantic coast and Lower Lakes, and changing to snow in the northern portions of New England and the Lake region. 15th, by midnight the two had united over the Gulf of St. Lawrence, with diminishing central pressure; Chatham 29.20, or 0.63 below the normal. During the day it was succeeded by clearing weather, except in the Lake region and St. Lawrence valley, where it cleared away at night. Maximum velocities: Indianola, N. 36; Cape May, NE. 32; Atlantic City, NE. 37; Barnegat, NE. 36; Sandy Hook, NE. 48; Boston, E. 30; Eastport. NE. 35; Duluth, N. 32; Sandusky, SW. 34; Buffalo, W. 37; Mt. Washington, SE. 84 and NW. 96 miles. Cautionary Signals which had been ordered on the 13th for the preceding disturbance along lakes Superior and Michigan, were continued as well as along the North Carolina coast. Morning of the 14th, they were ordered from New Jersey to Maine, and warnings sent for the Canadian stations in Nova Scotia and New Brunswick; afternoon for Lake Huron. Noon of the 15th, for Lake Erie; afternoon they were changed to Off-shore from North Carolina to New Jersey. Except over northern Lake Huron, they were generally justified, as shown by the preceding velocities. There was a failure to order signals for the Texas coast.

No. X—On the 15th this disturbance advanced southeast from British America over the extreme Northwest, producing light snows and occasional high winds. 16th, a. m barometer at Omaha 0.50 below normal. It passed eastward over the Lake region with diminishing energy, and snow fell from Idaho eastward over the Lake region. Maximum velocities: Umatilla, W. 32; Virginia City, W. 32; Cheyenne, W. 50; on Pike's Peak, W. 62; Sandusky, NW. 27 miles. Cautionary Signals were ordered morning of the 16th for the Upper Lakes, and warnings sent for Canadian stations on lakes Huron and Erie; afternoon, for Lake Erie; midnight, for the New Jersey coast (late.) For the larger number of stations the signals were not justified.

No. XI—slowly developed on the 17th east of the North Pacific coast. By midnight of the 18th the pressure at Boise City and Salt Lake City was 0.40 below the normal. It was accompanied by light rains along the Middle and North Pacific coasts, and snow thence toward Dakota. On the 19th, as storm No. XIII advanced it lost its identity, but sent out to the Southern States a slight depression. Afternoon of the last date signals were ordered for the New Jersey coast and partly justified.

No. XII—was a slight disturbance which developed over the Upper Lake region on the 19th. As it progressed eastward it was accompanied by numerous light snows. Cautionary Signals were ordered midnight of the 20th, for the New Jersey coast. Morning of the 21st, for the North Carolina coast. The latter were late. High northerly winds were produced along the coast from North Carolina to Nove Scotia, due to the advance of high pressure No. VIII, with a steep barometric gradient.

Nos. XIII and XIV.—The former was an unusually extensive and severe storm, and affected the entire country during its passage, except from Florida to South Carolina. During the day of the 18th the pressure, which had been left below the normal by low pressure No. XI, remained stationary, but at night, fell rapidly, with heavy rain in northern California. 19th, early in the morning southeasterly gales prevailed in the northern half of California, which during the day backed to southwesterly and extended to Nevada; in Oregon and part of Washington Territory, northeasterly gales. Rain became general in California, unusually heavy in northern portion, turning to snow toward Montana, Idaho and Washington Territory. By midnight the barometer at Red Bluff fell to 29.32, or 0.76 below normal. 20th, the rain-area extended to New Mexico and snow to Dakota, with high winds and gales at many points. 21st, its movement to the Lakes was very rapid, with generally light rains in Tennessee and the Ohio valley, but turning to snow, thence to the Northwest, Lakes and Middle States. 22nd, the main depression was gradually dissipated as it passed toward the St. Lawrence valley. No. XIV developed on the Middle Atlantic coast, and moved northeastward. The gradient became very steep, owing to the presence of high pressure No. VIII in front it, and northeast gales, with heavy snow resulted along the coast. During this and the preceding day thunder-storms occurred from Missouri, Illinois, Indiana and Iowa to Tennessee. Maximum velocities: San Francisco, SE. 36; Sacramento, S. 39; Red Bluff, SE. 52; Los Angeles, SE. 27; Winnemucca, SW. 45; Umatilla, NE. 52; Pioche, S. 36; Salt Lake City, SE. 31; Pike's Peak, SW. 68; North Platte, SW. 40; Dodge City, N. 40; Indianola, S. 31; Milwaukee, E. 41; Alpena, SE. 40; Erie, S. 36; Barnegat, E. 32; Sandy Hook, E. 44; Boston, N. 30; Eastport, NE. 37; Quebec, E. gale; Mt. Washington, NW. 84 miles. On the morning of the 21st, Cautionary Signals were ordered for Lakes Michigan, Huron and Erie; afternoon for Lake Superior, and warnings sent for Canadian stations on Lakes Huron and Erie; midnight for Lake Ontario, continued from North Carolina to New Jersey, and ordered up thence to Massachusetts, also warnings for Lake Ontario and St. Lawrence valley. Morning of the 22d, for coasts of New Hampshire and Maine, and warnings for Nova Scotia. These signals were fully justified. Off-shore Signals, ordered morning of the 22nd along the Texas coast for a "norther" were not justified.

Nos. XV, XVI and XVII.—The first crossed the North Pacific on the 21st, and Utah the 22nd. It was accompanied by rain along the Pacific coast, and by snow thence toward Utah. The barometric changes show that the second depression developed from the first and No. XIII, and appeared morning of the 23rd, in northeastern Texas. During the day as it progressed northeastward, threatening and rainy weather prevailed from the Western Gulf States to the Middle States, Lake region and Northwest, generally turning to snow in two last districts. 24th, the third developed on the New England coast, with rain and snow. Maximum velocities: Red Bluff, SE. 31; Winnemucca, SW. 34; Santa Fe, SW. 29; Ft. Sill, N. 40; Duluth, NW. 40; Alpena, E. 29; Wood's Holl, SW. 34; Eastport, E. 28; Mt. Washington, NW. 90 miles. Cautionary Signals were ordered, morning of the 23rd, for northern half of the North Carolina coast; afternoon, for New Jersey, Lakes Erie, Huron and Michigan, and warnings for Lakes Huron, Erie and Ontario; midnight, for Lake Superior, and Off-Shore Signals for a severe "norther" along the Texas coast. Morning of the 24th, for Lake Ontario and New England coast, and warnings for Nova Scotia. They were all lowered during the 24th, except on the Texas coast. Along the Lakes and southern New England coast they were justified at scattering stations, but in the other sections quite generally. During the 25th they were again hoisted from North Carolina to Maine, and in the afternoon changed to Off-Shore from New Jersey southward; also the remaining stations along the Gulf coast were ordered to display Off Shore Signals. The latter were reported not justified; the former, justified, except at scattering stations in New England.

Nos. XVIII and XIX.—The southern edge of the former produced rain along the North Pacific coast, and snow thence to Idaho on the 26th, also occasional snow in the Upper Lake region. On the 27th it moved southwestward toward Kansas, under the influence of No. XIX, which was central over the North Pacific coast at midnight; Olympia, barometer 0.64 below the normal. The pressure was decidedly below the normal from the Pacific coast to the Northwest and Southwest. Threatening and rainy weather prevailed in the North and South Pacific coast regions, Arizona and western New Mexico. Snow occasional-

ly fell from Nevada to eastern Washington Territory, Idaho, Montana and Dakota. 28th, No. XIX lost its identity at night in the Rocky Mountain region, while No. XVIII moved toward the Lake region with increasing energy. Rainy weather accompanied it in the Pacific coast regions, Arizona, New Mexico and the Ohio valley, and frequent snow to the northward. At Leavenworth the afternoon barometer read 29.31, or 0.70 below the normal. 29th it rapidly passed northeast to the Gulf of St. Lawrence, leaving a narrow barometric trough extending southwestward to Texas, in which rains were frequent, partly turning to snow to the northward. Maximum velocities: Pike's Peak, SW. 56; Cheyenne, W. 44; Dodge city, SW. 45; Bismarck, E. 32; Duluth, NE. 28; Milwaukee, SW. 28. on Mt. Washington, W. 105 miles. Cautionary Signals were ordered morning of the 27th for Milwaukee, Grand Haven and Ludington, on Lake Michigan, (the display of signals being ceased at the other Lake stations) but reported as not justified. Warnings were also sent for the Canadian stations, on Lakes Huron Erie and Ontario and St. Lawrence valley. Signals were also ordered the 28th for the Texas coast and Eastport, but not justified; also, warnings for Lake Huron.

No. XX.—This disturbance was central north of Minnesota and Dakota, night of the 30th; its progress southeast over the Lower Lakes on the 31st was very rapid, accompanied by fresh to very brisk winds, except on Mt. Washington, where a hurricane velocity (the highest for the month) was recorded. Snow frequently fell from the Northwest and Lake region to the St. Lawrence valley and New England, and rain thence southwestward to New Mexico and the Southwest. Maximum velocities: Virginia City, N. 30; Pembina, S. 34; Cleveland. SW. 28; Mt. Washington, W. 111 miles. Cautionary Signals were ordered, 31st, from New Jersey to Maine, and warnings sent for the St. Lawrence valley. They were only justified at scattered stations.

No. XXI.—The centre of this storm passed eastward from the Pacific coast to the north of the limit of the Signal Service stations. On the 31st rainy weather prevailed along the North Pacific coast, while high southerly winds and gales were general from thence to Montana; at Portland, Or., S. 25 miles; at Forts Shaw and Assiniboine, Montana, southerly gales; North Platte, S. 33. Its subsequent history belongs to the January REVIEW.

INTERNATIONAL METEOROLOGY.

Three International charts, Nos. IV, V and VI, accompany the present *Review*. No. IV indicates the probable course of low pressure areas over the North Atlantic ocean and neighboring waters and continents during the month of *November*, 1879; it is based upon observations made on board of nearly 200 vessels, and which have been collected from various sources or received directly at this office up to January 5th, 1880. Nos. V and VI are charts for the month of *May*, 1878, and are based upon the International Simultaneous Observations, as described in the *Review* for July, 1879, supplemented by such other observations as have been considered specially applicable and trustworthy.

On chart No. IV the tracks of seventeen areas of low pressure, which, during a portion of their existence, were located over the North Atlantic Ocean or neighboring waters, are traced. Although the number of reports at present to hand is somewhat small, they are probably sufficient to enable a good idea to be formed of the meteorological conditions existing over the North Atlantic, between the 35th and 55th parallels, during the entire month. In the following resume only the above area will be referred to unless specially noted. The month opened with areas of low pressure central respectively to the north of Newfoundland and over Norway and Sweden; the former being a continuation of low area No. IX shown on chart No. I of the October REVIEW, while the latter had apparently advanced southeastwardly to the Norwegian coast. Areas of high pressure existed over the eastern portion of the United States, moving eastwardly, and over the eastern portion of the Atlantic, moving slowly southeastwardly. On the 1st brisk to high westerly winds or gales prevailed from 65° to 45° W., and light easterly winds from 35° W. to the Irish coast. On the 2nd the pressure rose over the west Atlantic and British Isles as the high areas moved eastward and the low area north of Newfoundland northward. Westerly gales and high seas continued in the vicinity of the Banks of Newfoundland, (bark Royal Arch was abandoned in 43° N. 59° W.,) but thence eastward light or moderate southerly to easterly winds. 3rd, area of highest pressure central over the eastern Atlantic to the west of Ireland and extending its influence over all western Europe; light easterly winds between 10° and 25° W.; southwest winds and rain about 50° N., 35° W.; pressure over western Atlantic rapidly diminishing in advance of low area No. II, (low area No. I, chart I, November Review.) 4th, area of highest pressure central over Ireland, (Valentia, barometer 30.67 inches or 778.2 m. m., wind SW.;) light southerly winds thence to 40° W.; low area No. II moved rapidly northeastward during the night of the 3rd and 4th, accompanied by severe weather, with fierce squalls and heavy snow or rain, from Labrador to the Banks of Newfoundland; large area of high pressure over the eastern portion of the United States, moving eastward. 5th, area of high pressure over the east Atlantic, slowly moved southward, (Valentia barometer 30.69 or 779.5, wind calm,) while low area No. III advanced southeastward over Norway; southerly gales from 30° to 45° W., in advance of low area No. II; high or rising pressure over the west Atlantic, preceded by cold northwesterly winds and heavy snow off Cape Sable. On this day, 5th, two vessels were dismasted in a hurricane (low area No. IV) in 21° N., 27° W., which probably moved in a northerly direction on the 6th and 7th, and was encountered on the latter day in 30° N. 25° W. 6th and 7th, the center of highest pressure over the east Atlantic moved southward very slowly towards the Bay of Biscay, (barometer at